

Amendments to the Drawings:

Please replace original drawing sheet 4/9 with the attached replacement sheet 4/9. This replacement sheet includes changes to drawing FIG. 2E. Specifically, the additional insulating layer 316a and conducting layer 315a, recited in paragraph [0044] as amended are now shown in the new drawing FIG. 2E.

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REMARKS

The Final Office Action mailed April 15, 2005, has been received and reviewed. As of the April 15, 2005 Final Office Action, Claims 1-12 and 18-32 were pending in the application and presently stand rejected. Applicants have amended the Specification and Drawings as indicated herein. As of this amendment, Claims 1-12 and 18-32 are believed to be in condition for allowance and Applicants respectfully request reconsideration of the application as amended herein.

Drawings Objection

The Examiner has objected to the drawings under 37 C.F.R. § 1.83(a) for failing to show every feature of the invention specified in the claims, specifically, the second insulating layer in Claims 27, 29, 31 and 32.

Applicants submit herewith a new drawing, FIG. 2E, showing second insulating layer 316a and second conductive layer 315a. Support for the new drawing and the limitations in Claims 27, 29, 31 and 32 may be found in paragraph [0044] as amended herein.

Applicants respectfully request withdrawal of the drawing objection accordingly.

35 U.S.C. § 103(a) Obviousness Rejections

The Examiner has rejected Claims 1-12 and 18-32 under 35 U.S.C. § 103(a) for obviousness. M.P.E.P. 706.02(i) sets forth the standard for a § 103(a) rejection:

To establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on applicant's disclosure. *In re Vaeck*, 947 F.2d 488, 20 U.S.P.Q.2d 1438 (Fed. Cir. 1991), emphasis added.

Obviousness Rejection Based on U.S. Patent No. 5,598,052 to Khan et al. in view of U.S. Patent No. 5,475,281 to Heijboer

Claims 1-3, 7, 9, 11-12, 18-20 and 22-32 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Khan et al. in view of Heijboer. The Examiner acknowledges that Khan et al. fails to disclose a cathode comprising a first insulating layer. However, the Examiner asserts that Heijboer discloses the use of an insulating layer in a cathode and that it would have been obvious to combine the insulating layer of Heijboer with the cathode device of Khan et al.

Heijboer appears to disclose a cathode structure having a silicon nitride insulating layer 10 between the heating element 8 and the metal layer 12 having an emissive material 13. However, the cathode of Heijboer appears to be a standalone cathode device for use in cathode ray tube (CRT) displays. [Col. 1, Lines 13-15 and Claim 6.] There is no disclosure in Heijboer whatsoever regarding an anode, a grid, a seal, a circuit for heating the cathode or a control circuit for controlling the magnitude of the flow of electrons through the aperture of the grid as recited in Claim 1. Clearly, there is no suggestion or motivation in Heijboer to use the cathode structure with insulating layer as disclosed in a vacuum microelectronic device such as that disclosed in Khan et al. Conversely, as previously argued, there is no motivation or suggestion in Khan et al. to include an insulating layer such as that disclosed in Heijboer in the Khan et al. cathode structure. In fact, Khan et al. is silent as to any insulating layer on the cathode structure.

Furthermore, the purpose of the Heijboer silicon nitride insulating layer 10 is apparently to facilitate indirect heating of the metal layer 12 via the heating element 8. While embodiments of the present invention may include indirect heating of a cathode, Claim 1 recites a cathode 351 that is directly heated by conductive layer 315. The function of insulating layer 316 is to electrically isolate conductive layer 315. [See, paragraph [0041] in the specification.] Since there is no heater or indirect heating in the Khan et al. cathode, there would be no motivation to add an insulating layer to the cathode of Khan et al. regardless of the Heijboer disclosure.

Moreover, it is not obvious how one might insert the cathode structure of Heijboer into the vacuum device of Khan et al. without undue experimentation or with any likelihood of success. For all of these reasons, Applicants believe that Claim 1 is nonobvious over Khan et al. in view of Heijboer.

As Claims 2-3, 7, 9, 11-12 and 23-27 depend from Claim 1, they are also believed to nonobvious over the asserted combination of Khan et al. in view of Heijboer.

Claim 18 shares the same limitation as Claim 1, namely "a cathode comprising a first insulating layer" that is not disclosed in Khan et al. and is nonobvious in view of Heijboer for the same reasons outlined above. Claims 19-22 and 28-32 depend from Claim 18. Thus, they too are believed to be allowable over the asserted combination of Khan et al. in view of Heijboer.

Applicants respectfully request reconsideration of the obviousness rejection of Claims 1-3, 7, 9, 11-12, 18-20 and 22-32 based on Khan et al. in view of Heijboer.

Obviousness Rejection Based on U.S. Patent No. 5,598,052 to Khan et al. in view of U.S. Patent No. 5,475,281 to Heijboer in further view of U.S. Patent No. 5,686,790 to Curtin

Claims 4-6, 8 and 21 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Khan et al. in view of Heijboer in further view of Curtin. The Examiner acknowledges that Kahn et al. and Heijboer are silent regarding a second grid as recited in Claim 4. However, the Examiner asserts that Curtin teaches such a second grid.

Curtin discloses a flat panel device with a ceramic backplate. Curtin discloses multiple grid structures for directing electrons in a field emission device. As an initial matter, a field emission device (FED), such as the one disclosed in Curtin, operates on very different principle than a thermionic emission device such as those recited in Claims 4-6, 8 and 21 of the present invention and the thermionic devices of Khan et al. and Heijboer.

In a field emission device, the grid structure is necessary for pulling electrons off of the surface of a cathode. The cathode of an FED operates cold. Without a high field generated by the grid structure of an FED, there will be no current, i.e., no electrons

pulled from the cathode and traveling to the anode. Furthermore, the grid must be close to the cathode of an FED and its purpose is to focus electrons hitting the anode target.

On the contrary, there is always conduction and surface electrons available for current in a thermionic emission device of the present invention. A grid in a thermionic device is actually necessary to turn off the flow of electrons between the hot cathode and the anode.

Thus, the purposes and function of grid structures in FED devices are fundamentally different than those associated with thermionic devices of the present invention. For these reasons, one of skill in the art at the time of the invention would not likely have thought to combine the grid structures disclosed in Curtin FED devices with the thermionic devices disclosed in Khan et al. or Heijboer. There is simply no motivation or suggestion to do so and there would be no likelihood of success.

Additionally, the addition of Curtin to the previously asserted combination of Khan et al. in view of Heijboer still fails to render obvious the cathode having an insulating layer recited in independent Claims 1 and 18.

As Claims 4-6 and 8 depend from currently amended Claim 1 and Claim 21 depends from currently amended Claim 18 the asserted combination of Khan et al. in view of Heijboer in further view of Curtin fails to make a *prima facie* case of obviousness for the reasons cited above. For these reasons, Applicant respectfully requests reconsideration of the obviousness rejection of Claims 4-6, 8 and 21 based on Khan et al. in view of Heijboer in further view of Curtin.

Obviousness Rejection Based on U.S. Patent No. 5,598,052 to Khan et al. in view of U.S. Patent No. 5,475,281 to Heijboer in further view of U.S. Patent No. 6,465,132 to Jin

Claim 10 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Khan et al. in view of Heijboer in further view of Jin.

The addition of Jin to the previously asserted combination of Khan et al. in view of Heijboer still fails to render obvious the cathode having an insulating layer recited in independent Claim 1 as outlined above. As Claim 10 depends from currently amended

Claim 1, original Claim 10 is believed to be nonobvious in view of the asserted combination of Khan et al. in view of Heijboer in further view of Jin for the same reasons.

For these reasons, Applicant believes that Claim 10 is nonobvious over the asserted combination of Khan et al. in view of Heijboer in further view of Jin and respectfully requests reconsideration of the obviousness rejection.

CONCLUSION

Claims 1-12 and 18-32 are believed to be in condition for allowance, and an early notice thereof is respectfully solicited. Should the Examiner determine that additional issues remain which might be resolved by a telephone conference, he is respectfully invited to contact Applicants' undersigned attorney.

The Commissioner is hereby authorized to charge any additional fee or to credit any overpayment in connection with this Amendment to Deposit Account No. 50-0881.

Respectfully Submitted,



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Enclosure: Replacement Sheet 4/9 for drawing FIG. 2E